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SPOTLIGHT ON THE AGRIPRENEURIAL SIGNIFICANCE OF INSECTS IN INDIA

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ABSTRACT

India's Economy is mostly based on agriculture. Over 65% of Indians rely on agriculture for their living, either directly or indirectly, and it contributes between 16-17% of the nation's GDP. People are solely dependent on agricultural farming for their livelihood. Since the Indian economy is mostly based on agriculture, it may support agribusiness, food processing, and other related industries. There are a plethora of applications and advantages for insects in agriculture, medicine, industry, and research. They have been raised for food, fodder, dyes, and silk manufacture. Insects can be very big business. They are sold along with their products for crop pollination, pharmaceuticals, health, agricultural protection, and nutrition for humans, pets and cattle. Because they perform essential ecosystem functions for crop production, insects are essential to human survival. They play a significant role in enhancing agricultural soil as well. When it comes to the diversity and abundance of their species, insects have achieved remarkable success. As the most abundant group of organisms on Earth, comprising approximately 66% of all animal species, insects are widely distributed and adept at dispersing and utilizing almost any form of organic matter. They are an essential component of all ecosystems and play a crucial role in our food chains by providing priceless ecosystem services.

Keywords: agriculture, economy, agribusiness, insects, ecosystem

INTRODUCTION

In the context of agriculture, agribusiness units established in the agriculture and related sectors are referred to as agripreneurship, which is synonymous with entrepreneurship. India needs Agripreneurship. It is fast emerging as a necessity for improving the production and profitability in agriculture and allied sectors. This specific type of entrepreneurship discussed could generate innovative solutions to some of the critical agricultural issues, Firstly, entrepreneurs can use precision farming techniques to increase crops productivity. Secondly, the input costs can be minimized by incorporating data-driven decision making and smoothening efficacy in the farm supply chain. Agripreneurship plays various roles in the growth and development of national economy through entrepreneurship development which increases the income level and employment opportunities in rural as well as urban areas (Bairwa et al. 2012a). Agripreneur is an individual who starts, organises and manages a business venture focusing on the agricultural sector. The major Agripreneurship opportunities are in agricultural inputs, farming processes, and technology, agriculture output processing, and other agriculture allied sectors like dairy development, poultry, horticulture, agriculture, and so on. Activities like diversification, precision farming, high–tech agriculture, global marketing, organic farming, etc. are also adding sustainable value. It is not only an opportunity but also a necessary force for improving the production and profitability in agriculture sector.

Agriculture as a sector has a huge potential to contribute to the national income by providing employment and income to the larger and weaker

section of the society. Agriculture have several areas of entrepreneurship which include the activities like, Dairying, Sericulture, Goat rearing, Rabbit rearing, Floriculture, Fisheries, Shrimp Farming, Sheep rearing, vegetable cultivation, nursery farming, farm forestry (Pandey et al. 2013). Insects are important because of their diversity, ecological role, and influence on agriculture, human health, and natural resources. Insects create the biological foundation for all terrestrial ecosystems. They cycle nutrients, pollinate plants, disperse seeds, maintain soil structure and fertility, control populations of other organisms, and provide a major food source for other taxa. Insects provide a wild variety of uses and benefits ranging from Agriculture to medicine, industries and research. They have been reared for food, feed, silk production and dye making. Insects make up the most numerous group of organisms on earth, around 66% of all animal species, and being good dispersers and exploiters of virtually all types of organic matter, can be found almost everywhere, forming an important part of every ecosystem and are vital within our food supply chains performing valuable ecosystem services. Arthropods have existed for more than 400 million years and survived the Permian and Cretaceous mass extinctions (Kim 1993). Insects have been hugely successful in terms of both species richness and abundance and insects and terrestrial arthropods are seen to be the largest contributors to species richness (Samways 1993; Stork et al. 2015). Insects account for approximately 66% of all known species (Zhang 2011), constituting more than three-quarters of today's global biodiversity (Kim 1993). Insects, as drivers of ecosystem functions, play a major role in agro-ecology, the management of agricultural systems in an ecologically sound and sustainable way (Pywell et al. 2015) by encouraging ecosystem services provided by beneficial organisms. Ecosystem services (ES) are the benefits that humans derive from ecosystems (Daily 1997). In terrestrial ecosystems insects play key ecological roles in diverse ecological processes such as nutrient cycling, seed dispersal, bioturbation (Fincher et al. 1981; De Groot et al. 2002; Nichols et al. 2008), pollination (Gabriel et al. 2006; Slade et al. 2016), and pest control (Landis et al. 2000; Brewer et al. 2004; Bell et al. 2008; Lonsdorf et al. 2009). Diversity is a central characteristic of natural ecosystems and facilitates these systems to be resilient and able to survive major changes. This biodiversity found in natural ecosystems can also be the key to sustainable agricultural production and food security.

ROLE OF INSECTS IN ECOSYSTEM

For as long as humans practiced crop agriculture, pests have occurred on their crops and insects have been predominantly perceived as competitors in the race for survival. Around 72% of the world's crops are dependent on insects for pollination (Dicke 2017). Pollinating insects improve or stabilize the yield of three-quarters of all crop types globally—one-third of global crop production by volume (Schwagerl 2016). A variety of insect taxa have been linked with increasing seed set (Hoehn et al. 2008). We frequently take these tiny organisms for granted because they balance our ecosystems and provide natural services like pollination, nutrient cycling, and soil profile maintenance. Insects regulate the populations of other organisms, pollinate plants, scatter seeds, preserve soil fertility and structure, cycle nutrients, and serve as a significant food source for other taxa (Majer, J.D; 1987).

Pollination

On the Earth, approximately 80% of flowering plants are pollinated through insects. The majority of plant species rely on insects to produce pollen. Plants can reproduce sexually and fertilization through a process called pollination, which is the transfer of pollen to new plants. There is a wide diversity of values linked to

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pollinators and pollination beyond agriculture. Approximately two-third of all plant species depend on insects for pollination, with over 75% of wild flowering plant species in temperate regions requiring them. Pollinators and their habitats provide ecological, cultural, financial, health, human, and social values. About 80% of plant species benefit from enhanced genetic diversity and reproduction due to pollinators. Insects that visit flowers and hover around blooming plants to feed on pollen and nectar are known as pollinator insects. Insect pollinators include hundreds of species of solitary bees, bumblebees, flies, beetles

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and butterflies (Schoonhoven 2005), and in several crops, wild bee species are more important for pollination than the honeybee, *Apis mellifera* (Garibaldi et al. 2013). As a result, insects indirectly increase animal biodiversity through pollination and contribute to plant diversity.

Pollination done by a butterfly

Predation/Parasitism

Occupying the higher trophic levels as secondary or tertiary consumers, predators and parasites help control the population increase of primary consumers or phytophagous organisms below a threshold. Herbivorous insects with the potential of becoming pests are under natural control by insect predators and parasitoids (van Lenteren 2012). Insect predators and parasites prey on other insect species, particularly plant pests, which are thought of as insects' natural enemies. A significant portion of the species belonging to the orders Hemiptera (bugs), Coleoptera (beetles), Diptera (flies), and Hymenoptera (which includes wasps, bees, and ants) contribute as predators in addition to the important predators associated with specific orders like Odonata (dragonflies) and Neuroptera (lacewings and ant lions). The term "parasitoids'' refers to insects that live inside their host from an immature stage until they mature into adults, at which point their parasites cause the host to die. The most valuable parasite carriers belong to the order Hymenoptera (Ichneumonid wasps) and Diptera (Tachinid flies). By contributing to pest mortality, which leaves pest populations more susceptible to herbivore attacks, parasitoids and predators can both reduce and halt the spread of pest populations.

Decomposition

The decomposition of dung and carrion that is significant for the ecosystem process is done by insects. Insects play a vital role in the decomposition of animal and plant matter, which is essential for the release of nutrients that are later utilized for growing plants. The process by which organic waste like dung and carrion, breaks down is a crucial ecological function that is primarily supported by insects. We observed dung beetles, which are crucial for recycling nutrients and eliminating waste on the surface. Animal dung is used by dung beetles to construct a tunnel wall and create dung balls, both of which are crucial for preserving the soil's quality and providing support for soil enrichment. The dung beetles in tropical forests play a vital role in the secondary dispersal of seeds as well, as they conceal seeds from rodent predators by covering them in dung (Shepherd and Chapman 1998). There are about 4000 documented dung beetle species which play an important role in the decomposition of manure. Dung beetles are principally important in the maintenance of pasture health by burying dung, which has the effect of removing surface wastes and recycling nutrients that can be used by plants. Dung beetles contribute to the carbon cycle reducing GHG emissions by between 7% and 12% (Nichols and Favila 2008). Dung beetles also contribute to soil health by increasing nitrogen, phosphorous, potassium, calcium and magnesium or total proteins content (Macfadyen and Schellhorn 2015). Ants, beetle larvae, flies and termites clean up dead plant matter and break it down for further decomposition by microbes. Carrion provides food to a diverse community of insects with major roles for insect detritivores such as flies and beetles (Merritt and De Jong 2015). Farwig et al. (2014) found that decomposition rate of carrion is dependent on composition not abundance of the assemblages of insect scavengers.

OTHER USES OF INSECTS:

Insects can be found in large numbers in our surroundings, including gardens, forests, and agricultural fields. However, we are unaware of which insect species are beneficial for us and which are harmful for us due to a lack of information. Thus, doing this is essential to learn more about the insects that inhabit our environment. Insects help humans both directly and indirectly in a number of ways.

Insect Farming for Textile

Silkworm, *Bombyx mori* L. (Lepidoptera: Bombicidae) is a holometabolous, commercially significant, highly domesticated insect known for producing Mulberry silk. It is a well-known, most beneficial insect that is often regarded as the Queen of textiles. Silkworm choose white mulberry leaves as a food. It can be domesticated and rear for silk production which has been exploited for over 4000 years ago. The development of cocoon is highly dependent on the feeding larvae stage whose nutritional appetites is on quality mulberry leaves (Alebiosu et al. 2014). Silk is a natural fiber with a wide market throughout the world. Traditionally, household spinners and weavers produce a variety of beautifully coloured fabrics for both domestic and ceremonial uses by blending different colors (Kanika et al. 2016). China and India are the best silk producing countries. Since they are the main source of fiber for humans, silkworms are an economically valuable insect. The preparation of the gut by silkworms for use in fishing and surgery has additional economic significance. The intestine must first be separated from the silkworm, then it must be formed into strings, dried, treated, and finally packed.

Insect Farming for Food

Edible insects are vastly nutritious and a correct source of essential nutrients that are necessary for the human diet. Some edible insect humans prefer as food that are related to the insect order such as Coleoptera (beetles), Lepidoptera (caterpillars), Hymenoptera (bees, wasps, and ants), Orthoptera (grasshopper, locusts, and crickets) and Hemiptera (cicadas, leafhopper, planthoppers, scale insects and true bugs). Humans have been eating insects for as long as 30,000 years ago. Insects have a dense protein content, high nutritional value and micronutrient and probiotic potential. Though their nutritional value varies greatly depending on the species, life stages, habitat, and diet of the insect, they have a specifically rich source of digestible proteins, fats, fibers, and micronutrients. Insects such as mealworms and crickets have high concenterations of vitamin B12, riboflavin, vitamin A and complete protein (van Huis et al. 2013). Palm weevils, *Rhynchophorus* spp, are excellent low cost sources of essential nutrients. They are commonly prepared roasted and are highly delicious, they have low carbon footprint if farmed as a commercial enterprise. Palm weevils serve as a traditional meal for natives of most rural societies (especially within the southern part of the country) but are not farmed for consumption rather harvested from the wild. (Muafor et al., 2015) reported indigenous method of palm weevil farming, the traditional grub gathering and grub semi-farming.

Insect Farming for Feed

Almost 60-70% increase in consumption of animal protein is predicted by 2050 to meet up with the population demands. This increase will require enormous resources, feed being the most demanding due to the scarcity of natural resources and climate change. Insect rearing could play a part in the solution. Insects show promise as animal feed. For instance, fly larvae can replace fish meal due to the similar amino acid compostion. It is possible to formulate fish meal to increase unsaturated fatty acid. Moths, grasshoppers as well as houseflies, have been used as feed supplements for poultry (Rumpold and B.A., 2013). The once that shows potential out of these insects are flies, especially the house fly (*Musca domestica*) (Diptera Muscidae) and the black soldier fly (*Hermetia illucens*) (Diptera Stratiomyiidae), which can be mass reared on-farm for domestic use, in small production units at the community or industrial level (Kenis *et al*, 2014). This is so because of its prevalence in most habitats, its fast development, and the possibility of obtaining high numbers of maggots and pupae naturally on various substrates without having to rear adults for egg laying.

Insect Farming for Medicines

Insects have been identified and reported to be used traditionally as traditional medicine worldwide (Denisha and Rokozeno 2016; Afam and Netshiheni, 2017). Some insects contain drugs inside their body, which is used as a cure. Cochineal insects (*Dactylopius coccus*) contain carminic acid, which helped in the treatment of whooping cough. Bristle beetles contain Cantharidine oil that helps in the treatment of hair restorers. In India 1,501 species of butterflies are found, has a tremendous potential in butterfly bioprospecting. Butterflies produce antibacterial proteins including cecropins, defensins and lysozymes. Butterflies may be a good source of novel bioactive materials such as anti-bacterial, anticancer drug. Tse-tse fly is used to avoid the sleeping sickness after having been bitten by the Tse-tse fly. Tse-tse fly is crushed and rubbed on the skin, and making an incision is also applied there (Tango et al.1994). Pierisin, a protein purified from pupa of cabbage butterfly, *Pieris rapae* exhibit cytotoxic effects against human gastric cancer. Extract of body fluids of other cabbage butterflies, *P. brassicae* and *P. napi* also contains

Pierisin. The domestic silkworm, *Bombyx mori*, is useful in the management of persistent diarrhea and leucorrhea. Honey and maggots are good for healing surgical and chronic wounds. The carrier of unani and ayurvdeic medicine is honey. Royal jelly is another honeybee product that is used to treat postmenopausal symptoms.

CONCLUSION

Agripreneurship is the need of hours to make agriculture a more attractive and profitable venture. It is clear that there is a great scope for entrepreneurship in agriculture. Insects, as major contributors to ecosystem function on all levels, perform critical functions in any ecosystem. We need to manage agricultural systems in such a way that insects performing valuable ecosystem services form a fundamental part of the system. Future research in sustainable agriculture should therefore focus on the role of insects in ecosystem. By understanding the important functions of insects in natural ecosystems their value in agricultural systems can be realized. With a knowledge of ecosystem functions provided by insects we can then accommodate these insects in agricultural systems by changing the management practices to increase the functional diversity in these systems. It is an interesting concept, managing pest insects by developing them into a sought after delicacy. Since edible insects are a nutrient-dense food source, it is important to consider them in a world where human nutrition has greatly improved. Consideration should be given to the importance of insect populations for agriculture, humans, education, medicine, and the natural world. Not every insect species can be preserved. Therefore, it is imperative to raise as much awareness as possible about the insect population and its sharp decline among the local population.

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